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$LaAlO_3/SrTiO_3$–**A Tale of Two Magnetisms**[1] YUN-YI PAI, ANTHONY TYLAN-TYLER, PATRICK IRVIN, JEREMY LEVY, University of Pittsburgh, Pittsburgh Quantum Institute — Ten years since the first report of magnetism by Brinkman et al.[2], a unified picture of magnetism at the two-dimensional electron system (2DES) between $LaAlO_3/SrTiO_3$ is still lacking. The understanding is further hindered by the complex interplay of magnetism and many other aspects of this system: multi-band superconductivity, quantum paraelectricity, multiferroicity, to name but a few. We argue that the reported magnetic signatures in this system can come from two principal origins[3]: (1) a ferromagnetic long-range order resulting from local magnetic moments mediated by itinerant electrons, and (2) metamagnetic phenomena associated with electron pairing without superconductivity [4] . Finally, we discuss possible experimental tests of this framework.

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[2]A. Brinkman *et al.*, Nat. Mater. **6**, 493 (2007)
[3]Y. Pai *et al.*, arXiv:1610.00789)
[4]G. Cheng *et al.*, Nature **521**, 196 (2015)

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